

# **Understanding CMMI Measurement Capabilities & Impact on Performance: Results from the 2007 SEI State of the Measurement Practice Survey**

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CMMI Technology Conference  
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# Today's Talk

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## Purpose & scope of the survey

### Results

- The respondents & their organizations
- Measurement resources & infrastructure
- Value added by measurement
- Software measures used
- Data quality & integrity
- Organizational perspectives on software measurement

### Summary, lessons learned & next steps



# Understanding the State of Measurement Practice

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Careful & well executed use of measurement & analysis

- Is a well accepted tenet in many fields of endeavor
- Including of course CMMI

Basic aims

- To inform management & technical decisions based on empirical evidence
- & to judge the results of those decisions once made

But, how well, and how frequently, are measurement practices put into effect in our own field?



# Surveys & Benchmarking

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## Benchmarking: The current state

- Some professional & consulting organizations maintain repositories they use for establishing benchmarks & facilitating benchmarking activities
- However, their measures & measurement definitions differ in many ways
- In that sense, one cannot speak confidently about “industry standards”
- Which is why the SEI has launched the Performance Benchmarking Consortium {as described at last year’s CMMI Technology Conference}

## The state of the practice surveys

- Aim to provide data that's not yet widely available
  - Updates of trends in typical use of measurement in software & systems engineering
  - To help projects & organizations judge their progress relative to others
- But there **also** will be a continuing need to track qualitative as well as quantitative descriptions about the quality & frequency of use of measurement in our field



# 2<sup>nd</sup> Annual SEI Measurement Practice Survey

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## New this year

- Screening question to identify respondents whose organizations develop software but rarely if ever do measurement
- Questions about
  - Resources & infrastructure devoted to measurement
  - Practices to ensure data quality & integrity
  - Value added by doing measurement
  - The kinds of measures used by the responding organizations

Among other things, these questions allow us to make some useful comparisons by CMMI maturity level



# Trends over Time

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1<sup>st</sup> survey described at last year's CMMI technology Conference

Similar results this year

- Moderately strong relationships exist when comparing the replies of respondents based on:
  - Management versus staff roles
  - Industry *versus* government organizations
  - The United States *versus* other countries
  - Organization size

But that's a topic for another time



# CMMI Measurement Capabilities & Performance Outcomes

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## Today's focus

- Provide evidence about the circumstances under which measurement capabilities and performance outcomes are likely to vary
- As a consequence of achieving higher levels of CMMI maturity

Most differences **are** consistent with expectations based on CMMI

- Which provides confidence in the validity of the model structure & content

However, the results also highlight areas where sometimes considerable room for improvement remains

- Even at maturity levels 4 and 5
- For example
  - A rather strong overall relationship exists between maturity level & use of measures about quality attributes
  - Little attention to quality attributes at the lower maturity levels
  - Yet, almost half of maturity level 4 & 5 respondents' organizations track quality attributes only occasionally at best





# The Sample

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Random sample of SEI customers

- 944 valid email invitations to participate

Data collected 20 February through 10 April 2007

- Two reminders

Response rate

- 41% completed all or part of the questionnaire
- N = 384
- Individual questions answered by 75-97% of respondents
  - ~29 – 39% of the sample invitees



# Today's Talk

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Purpose & scope of the survey

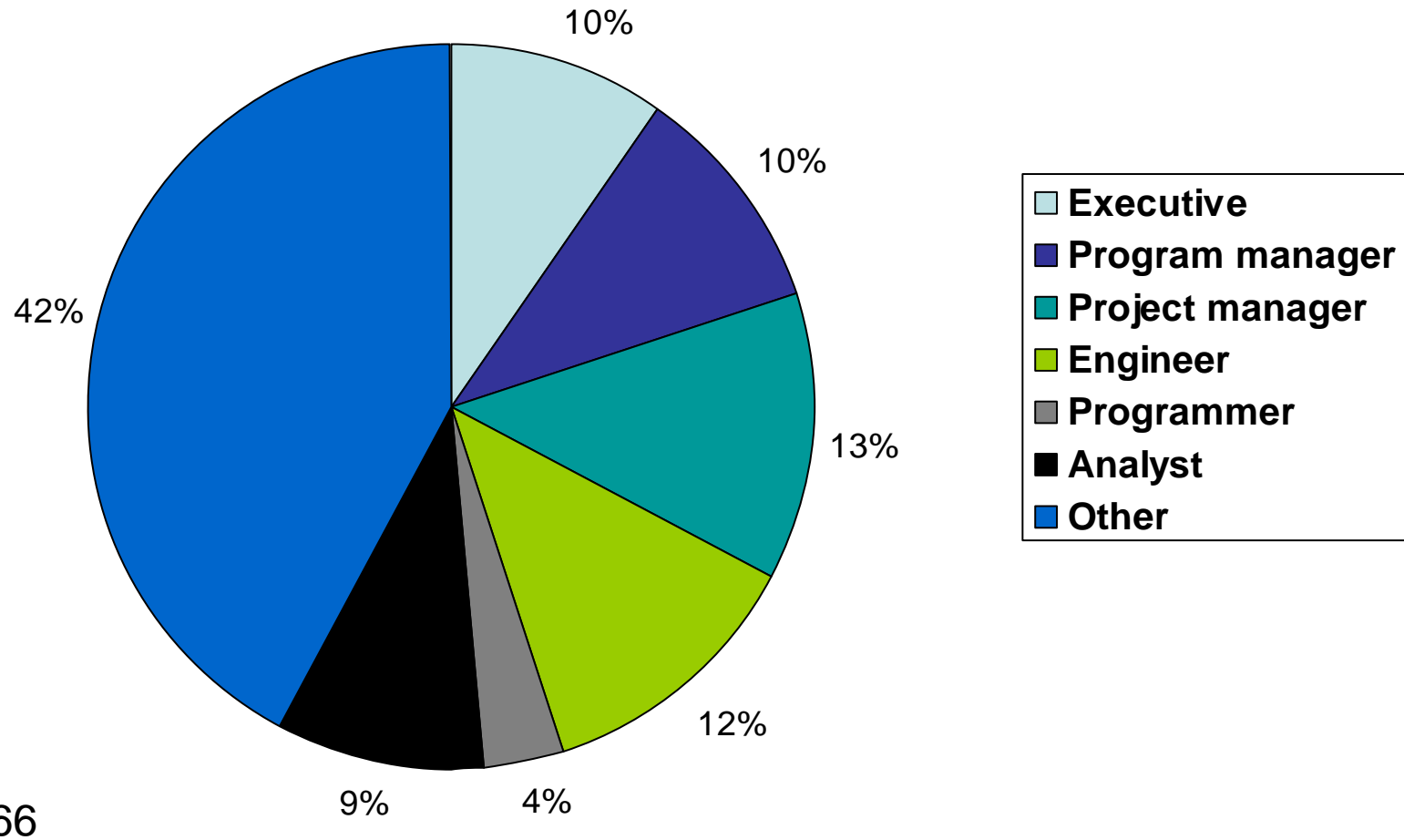
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Summary, lessons learned & next steps

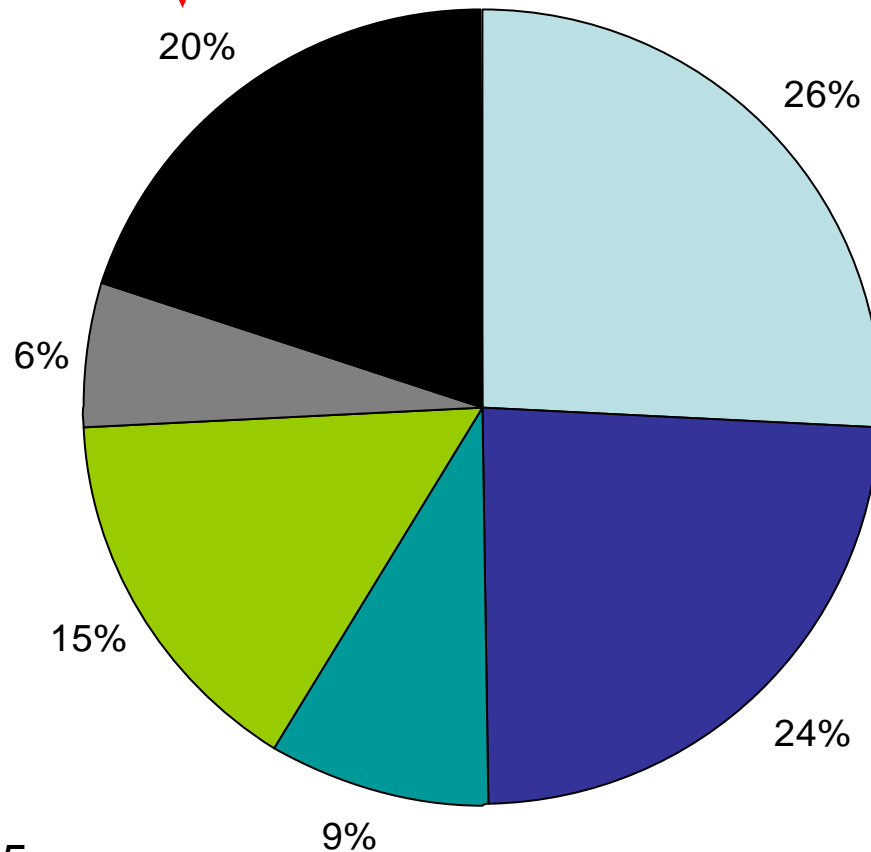


# Role in the Organization



# Who are the others?

**= 8% of all  
those  
responding**



N = 155

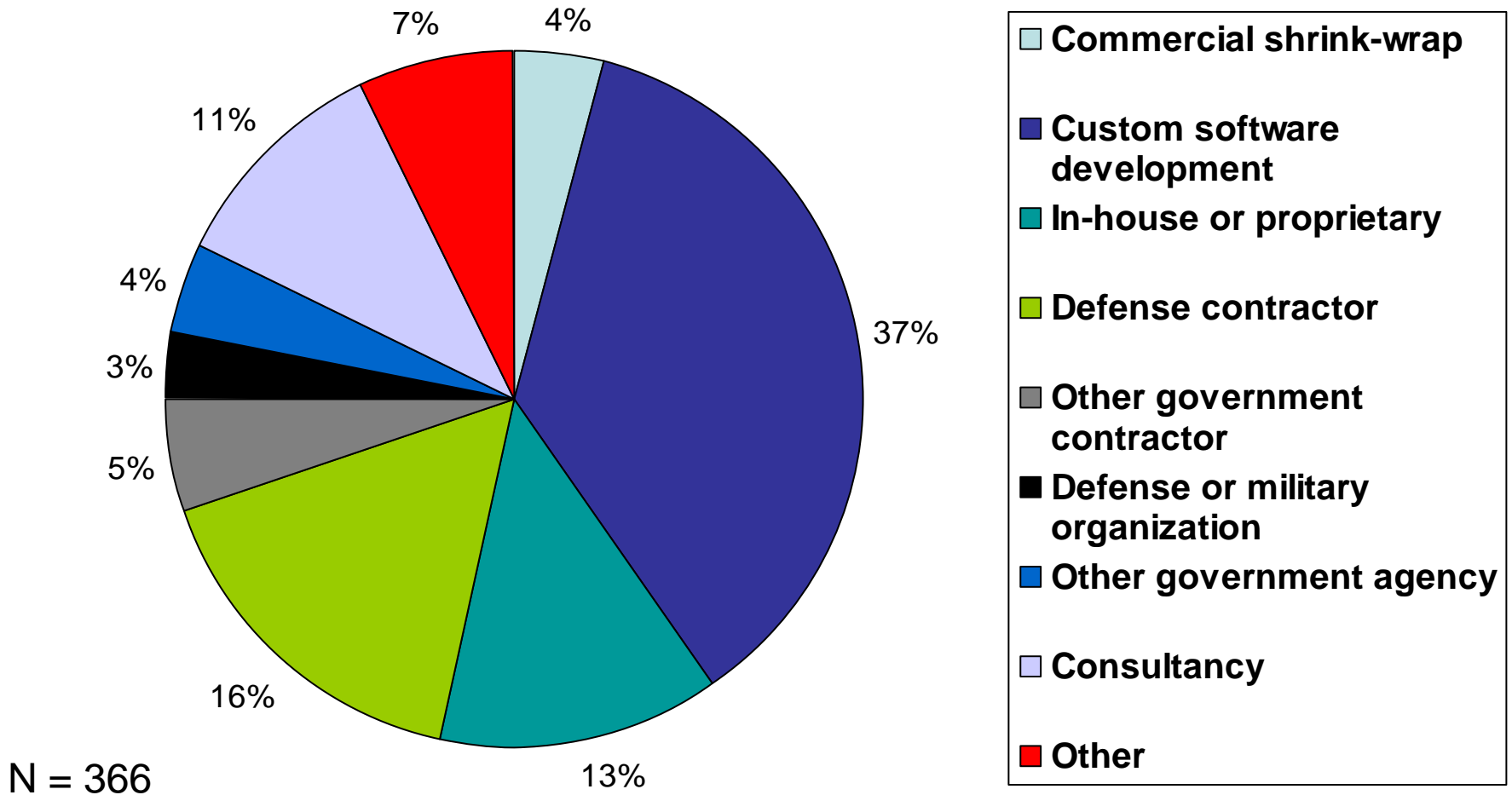


# And who are the other others?

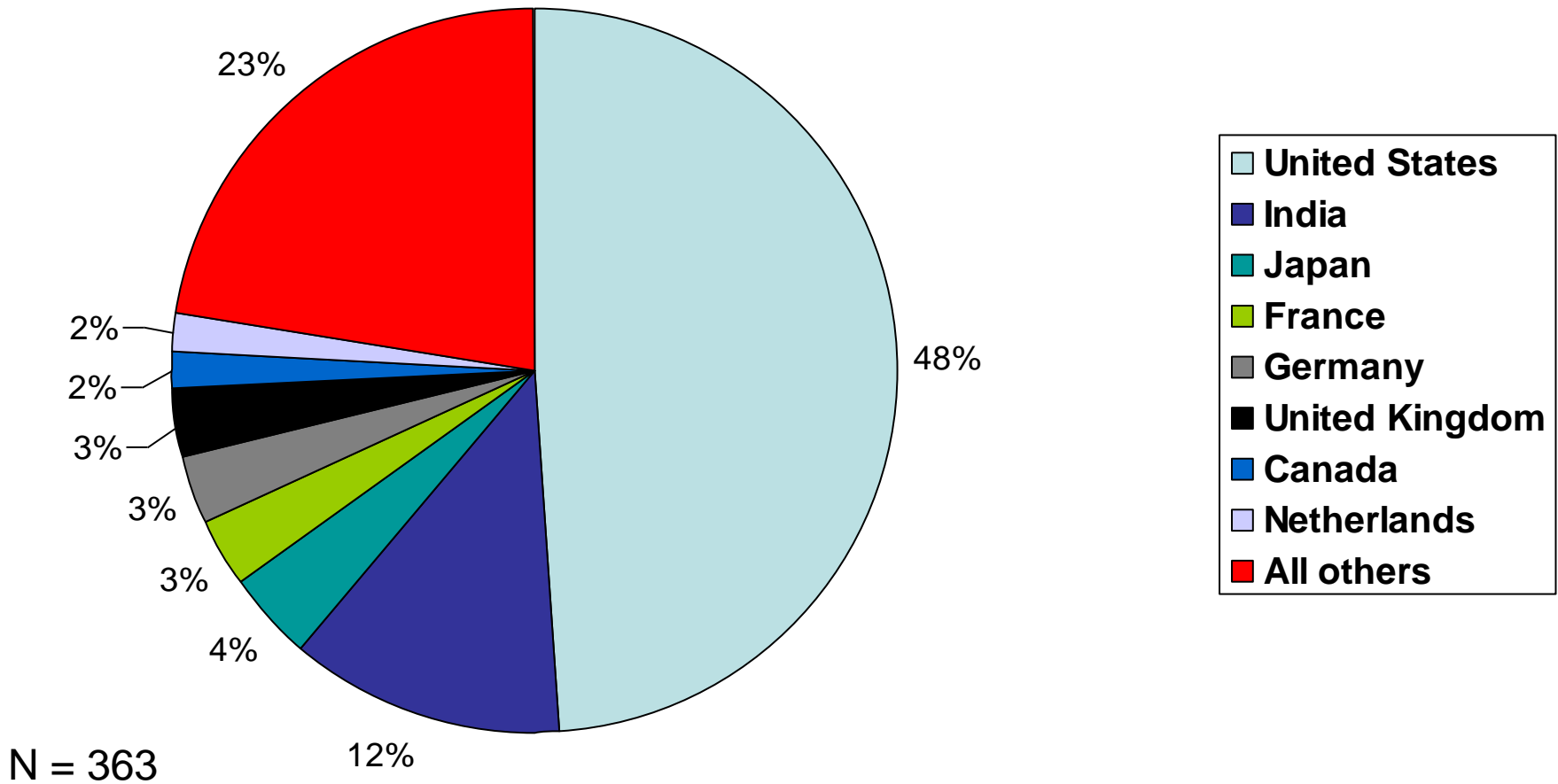
Process + Measurement	3	}	6	One each:	
Measurement Specialist	1				• Administrative support
Process + Quality + Measurement + Training	1				• Coach
Quality + Process + Measurement	1				• Consultant + researcher
Training	6				• Engineering Manager + Process
Architect	4				• Process + Project engineer
Security	2				• Program / team lead
Testing	2				• Program manager + Quality + Process
					• Project manager + Quality
					• Project manager + Engineer
					• Not specified
N = 31					



# Sector

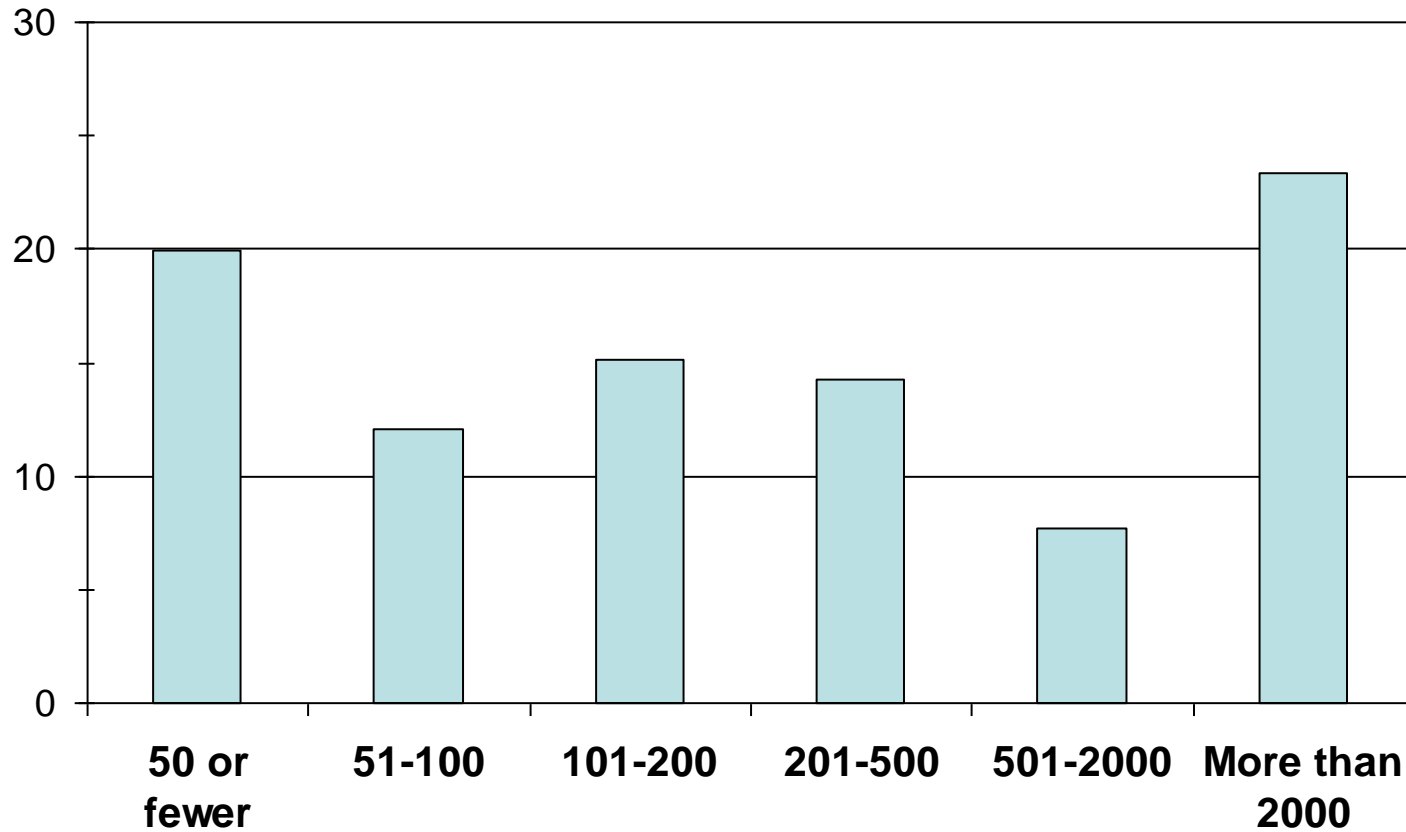


# Country



# FTE Staff

Percent

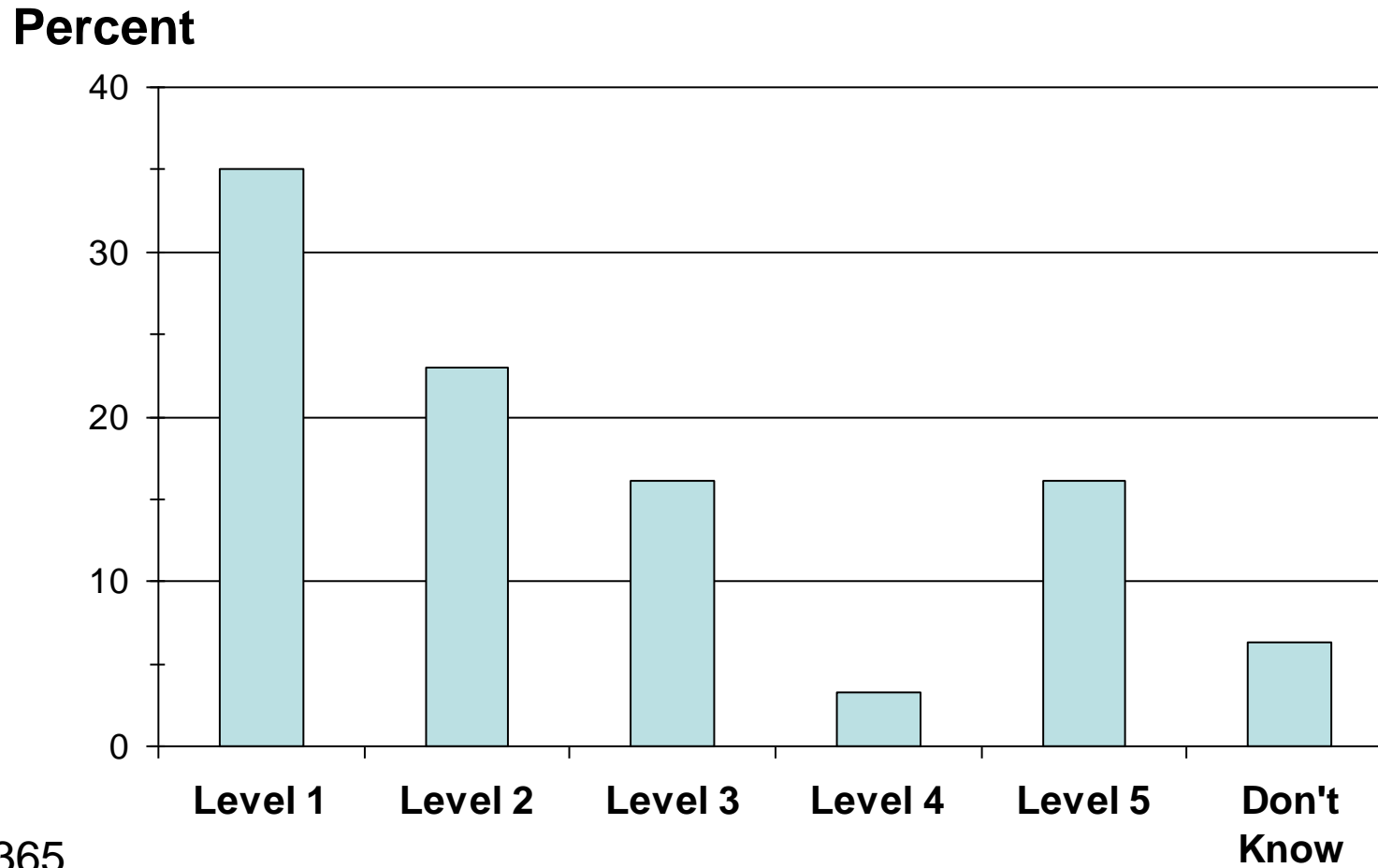


N = 364

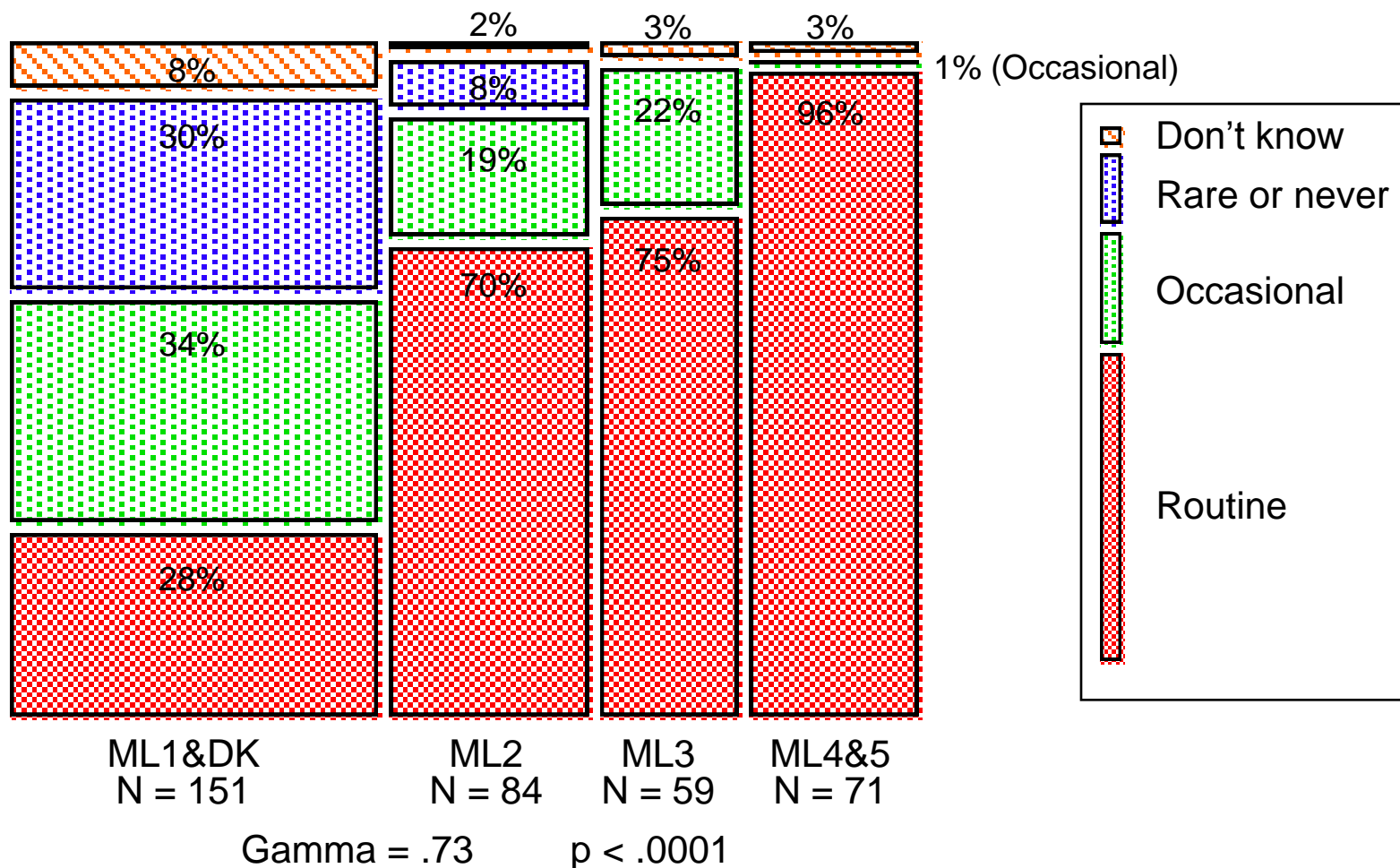




# Maturity level

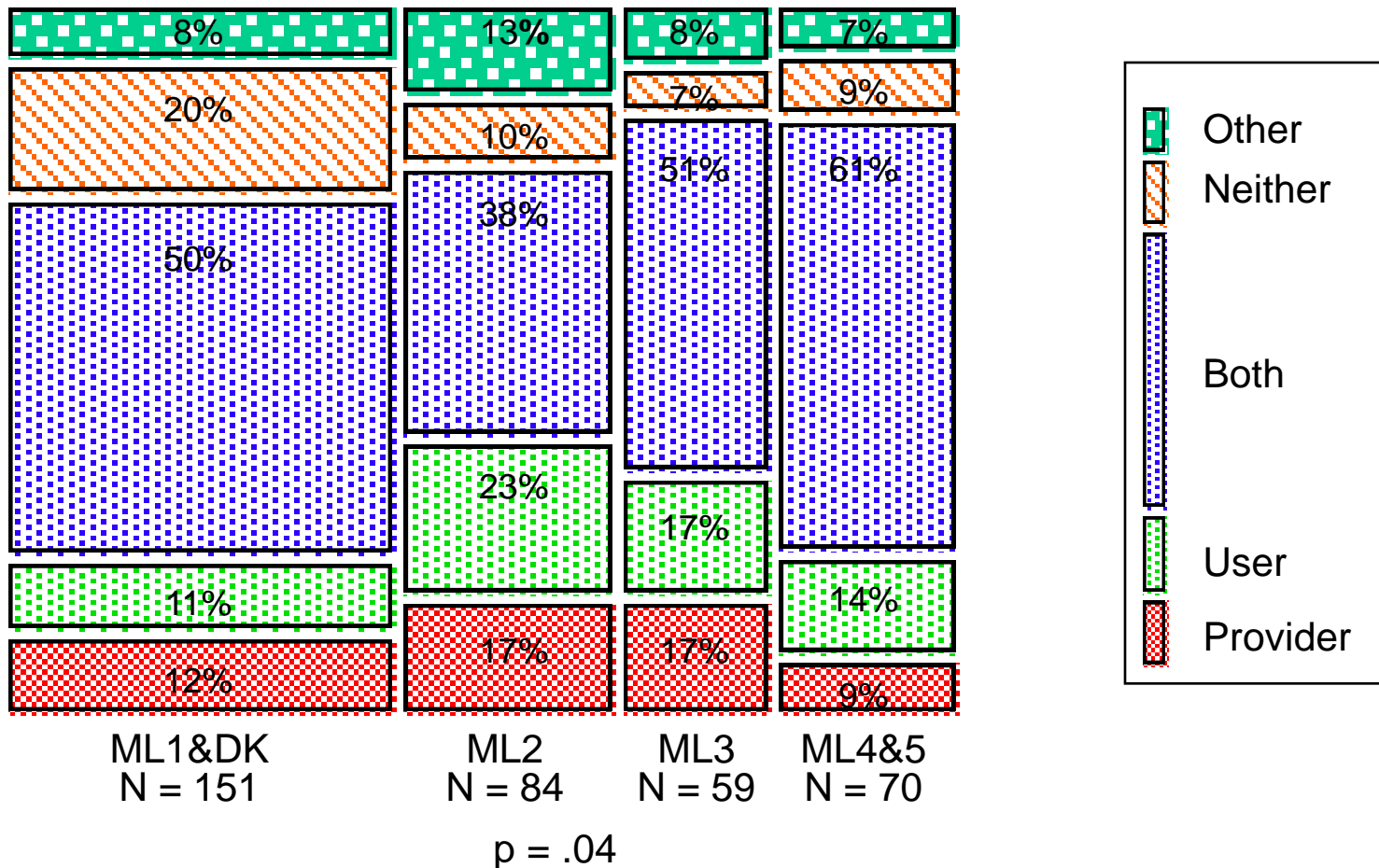


# Differences by Maturity Level: Use of Measurement in the Organization



# Interpreting the results:

## The Respondents' Measurement Roles



# Today's Talk

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Purpose & scope of the survey

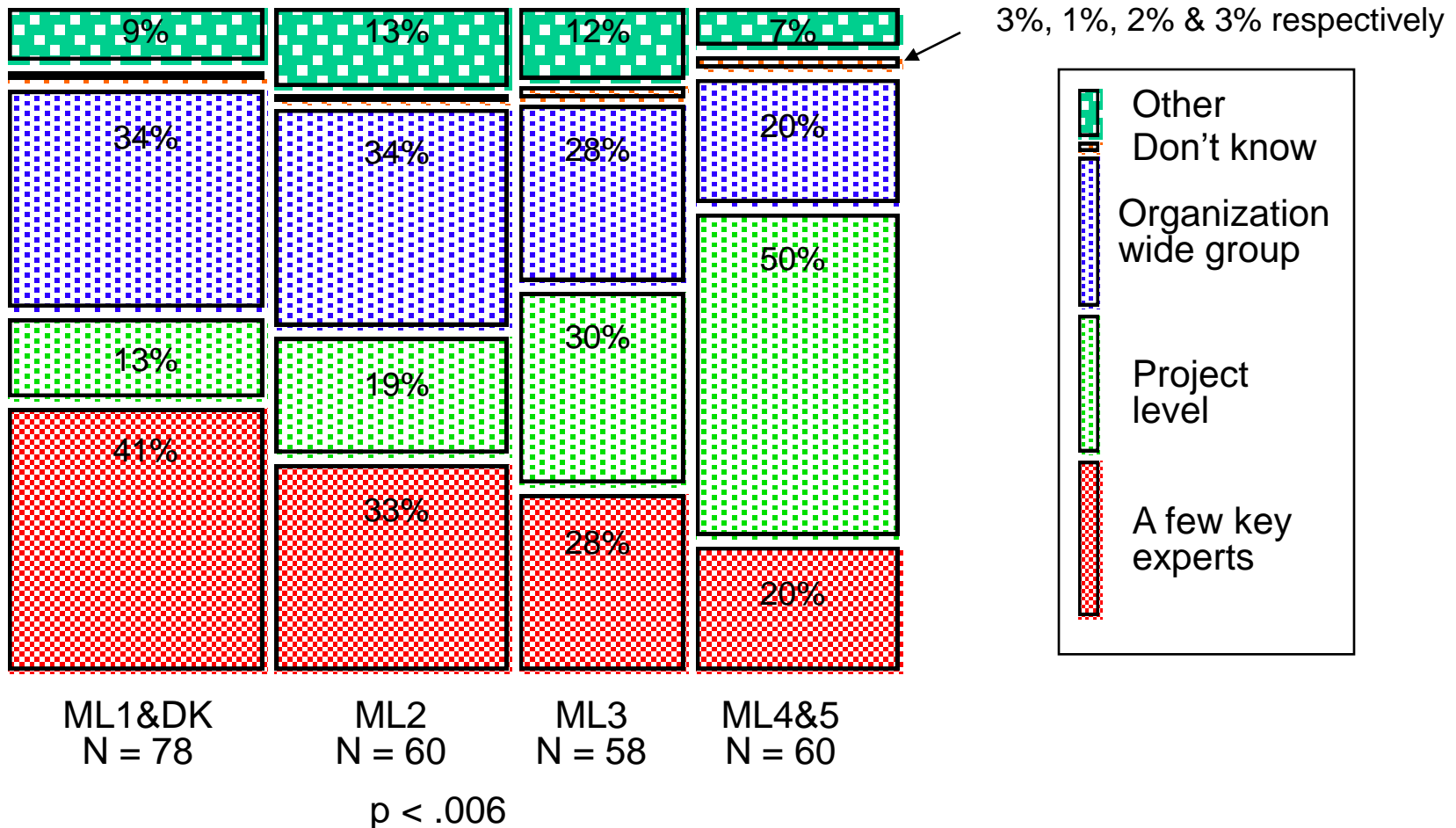
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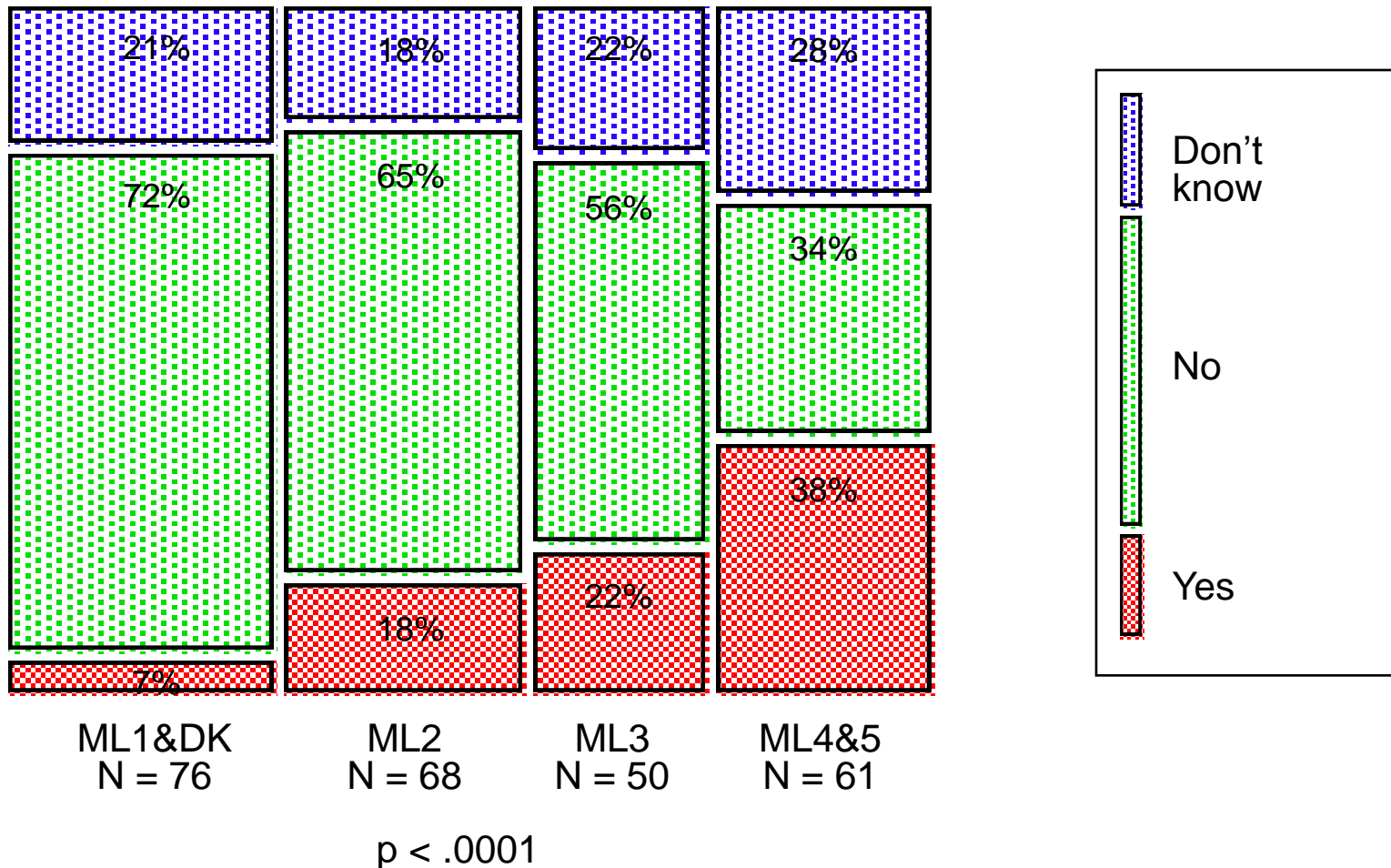
Summary, lessons learned & next steps



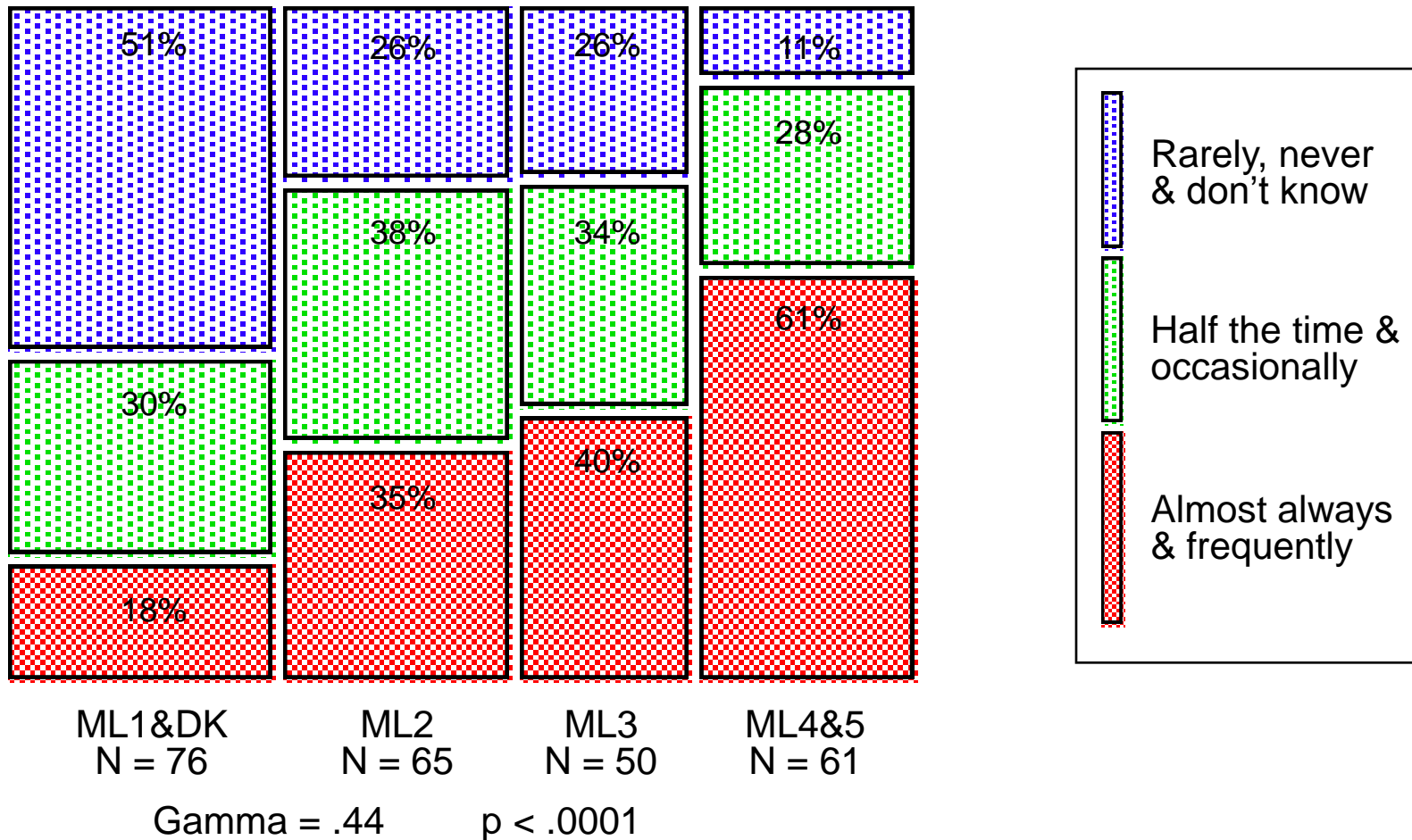
# How Measurement Work is Staffed



# Earmarked Budgets for Measurement



# Availability of Qualified Measurement Staff



# Similar Results

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For:

- Automated measurement support for data collection, data management, data analysis & reporting
- Use of commercial measurement packages & tools
- Existence of common, integrated organizational measurement repositories
- Availability of measurement related training

Proportions sometimes vary across the distributions.

But there are consistent differences by maturity level.





# Today's Talk

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Purpose & scope of the survey

Results

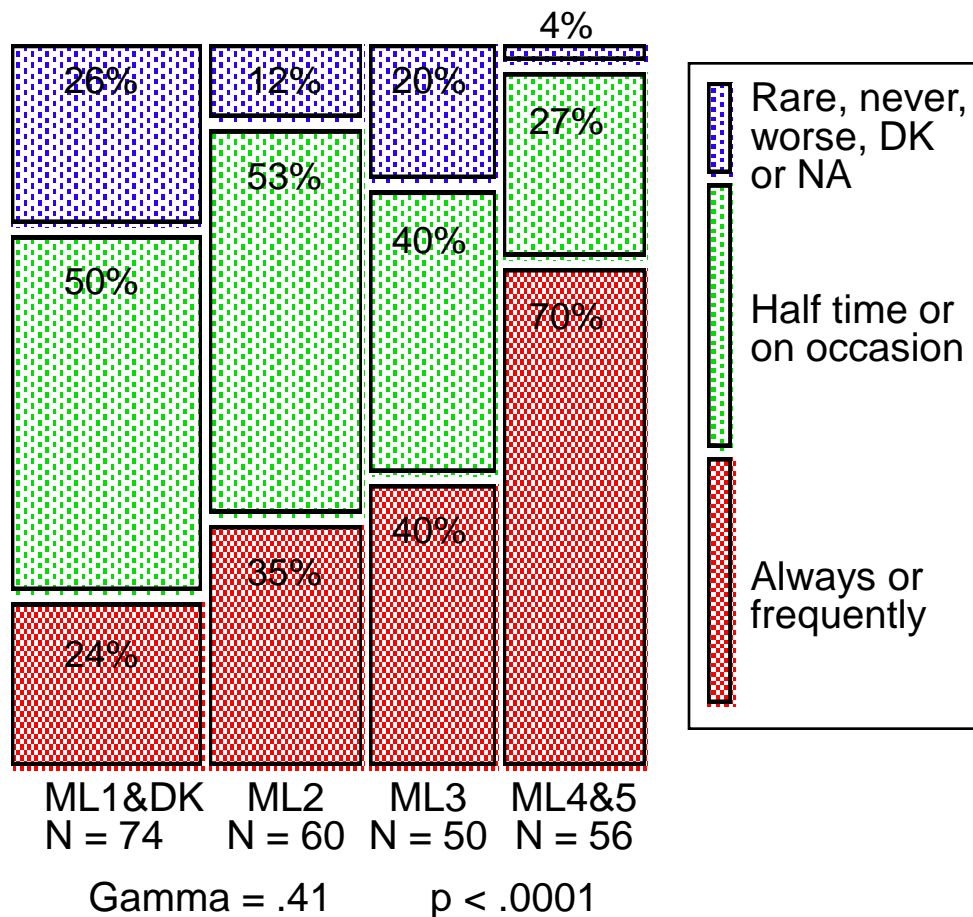
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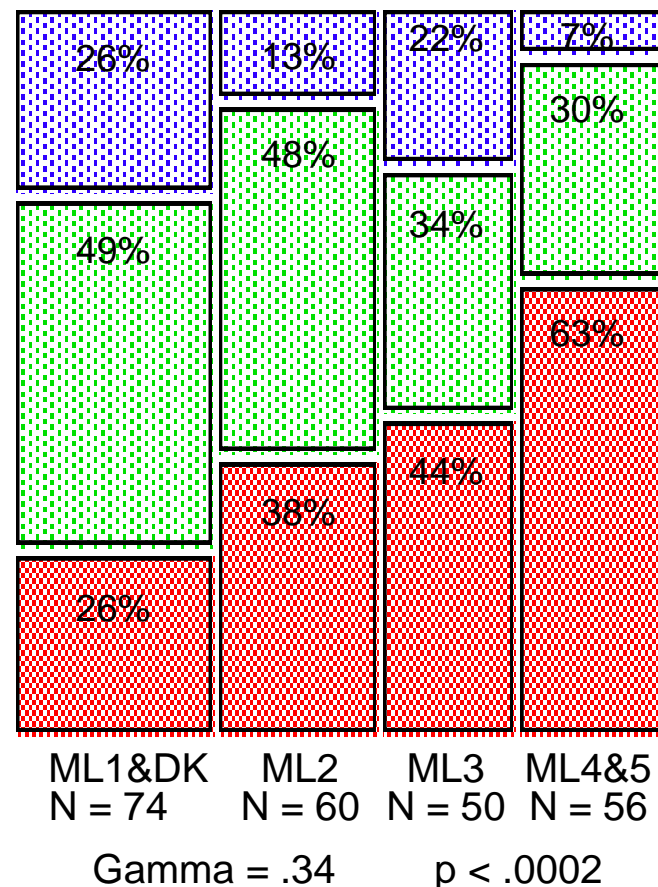


# Effects of Measurement on the Organizations<sub>1</sub>

## Better Project Performance

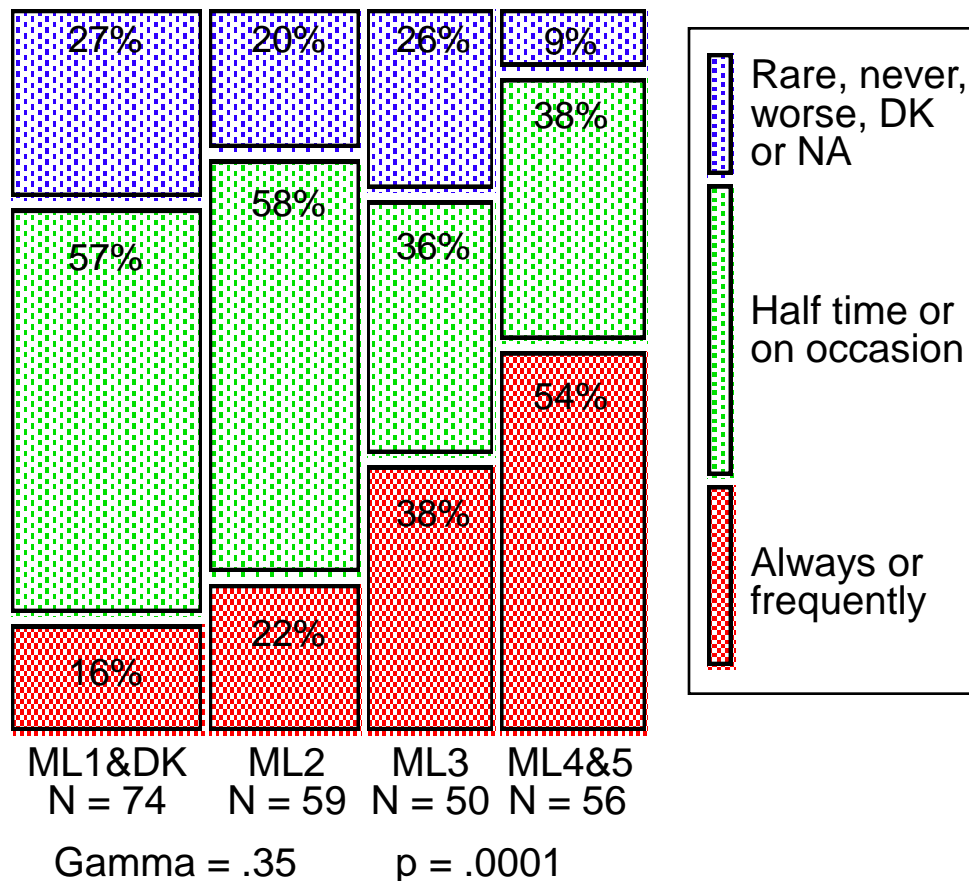


## Better Product Quality

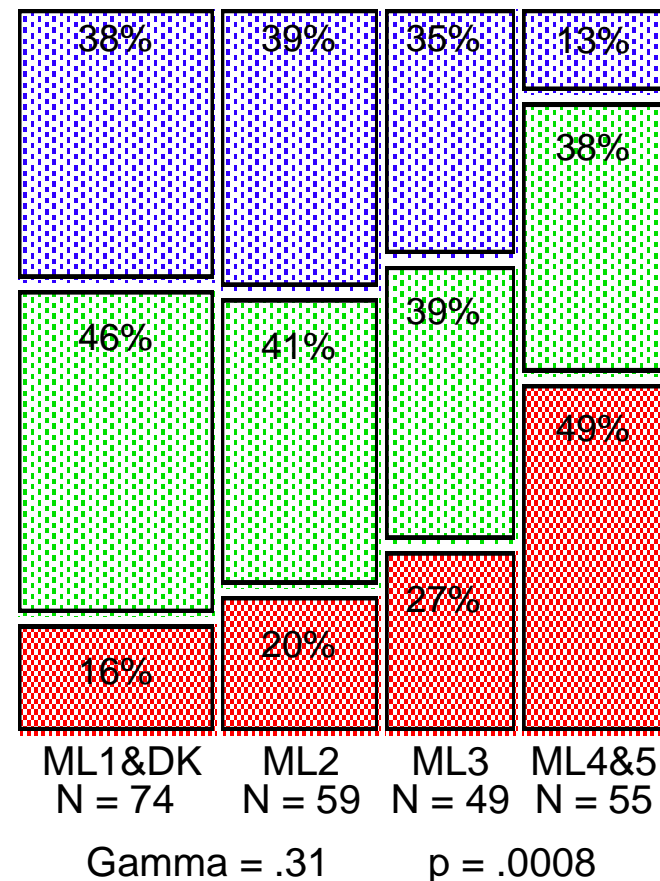


# Effects of Measurement on the Organizations<sub>2</sub>

## Better Tactical Decisions



## Better Strategic Decisions



# Today's Talk

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Purpose & scope of the survey

Results

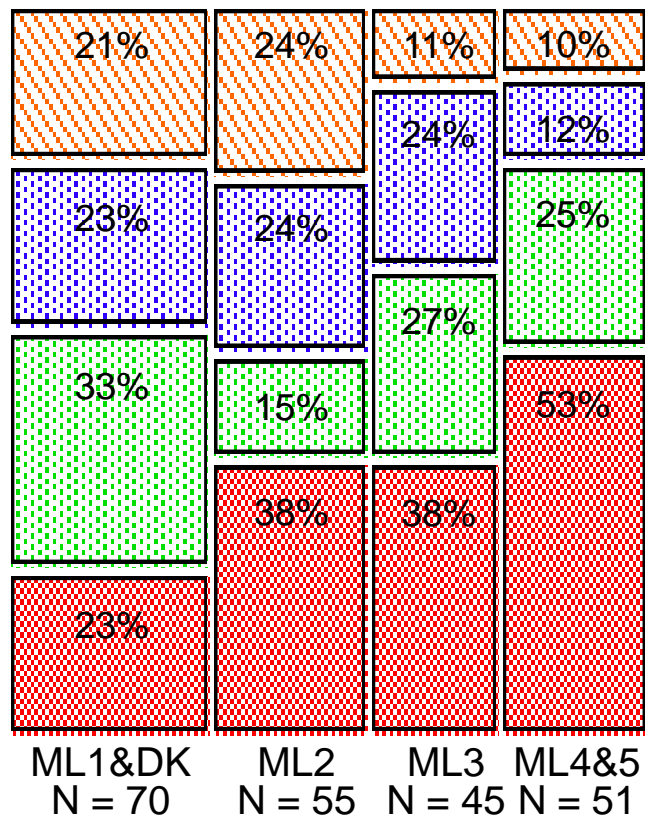
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# Project & Organizational Measurement Results Reported<sub>1</sub>

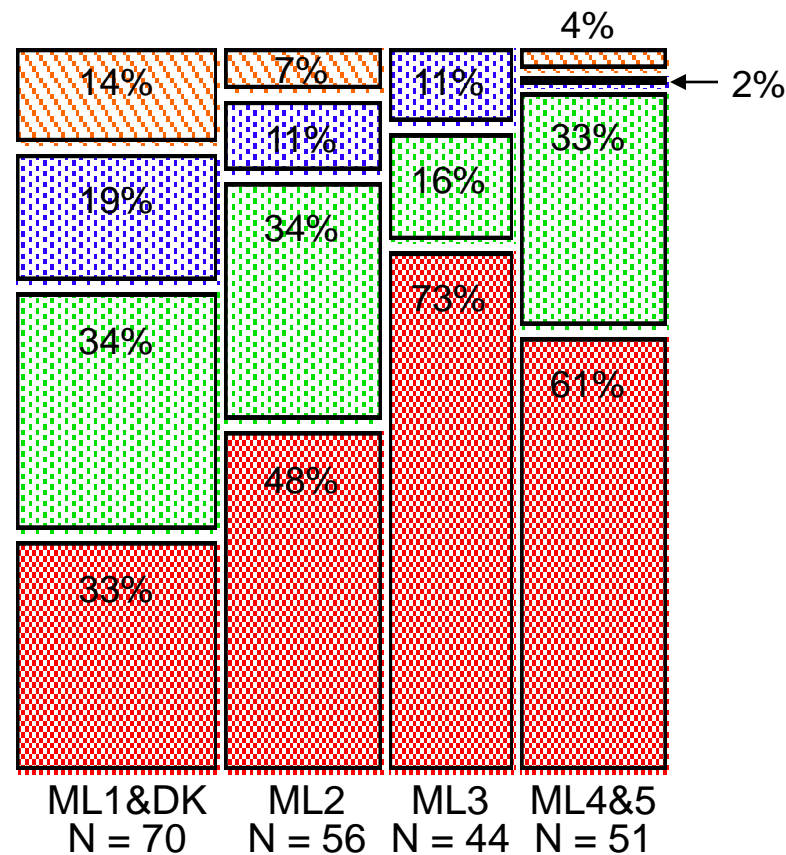
## Cost Performance



Gamma = .25

p < .03

## Schedule Performance



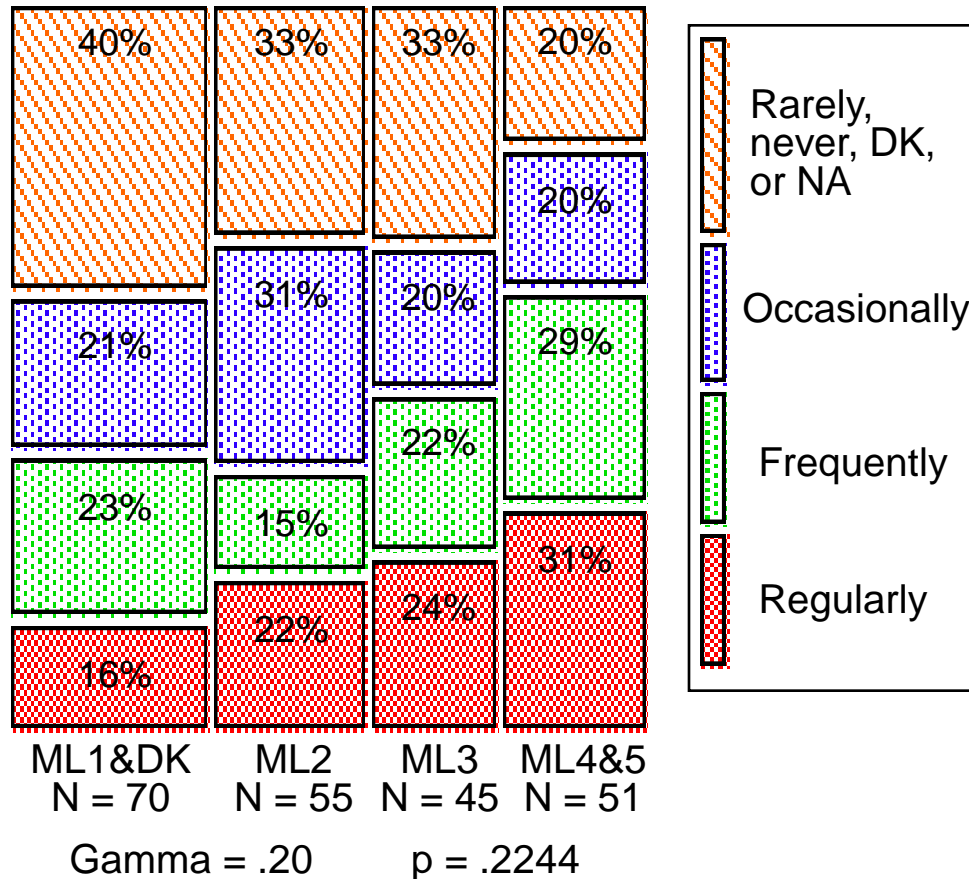
Gamma = .37

p = .0006



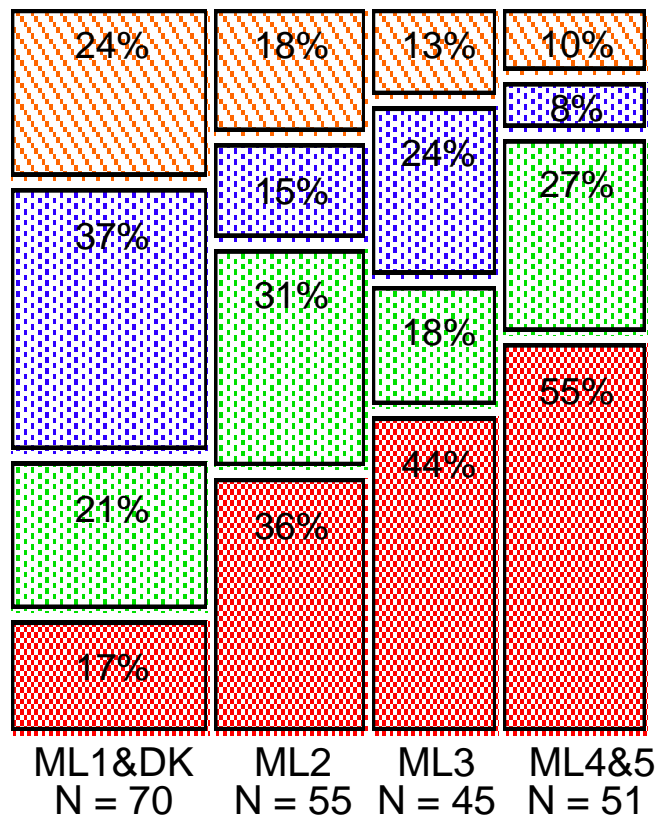
# Project & Organizational Measurement Results Reported<sub>2</sub>

## Business Growth & Profitability



# Product & Quality Measurement Results Reported<sub>1</sub>

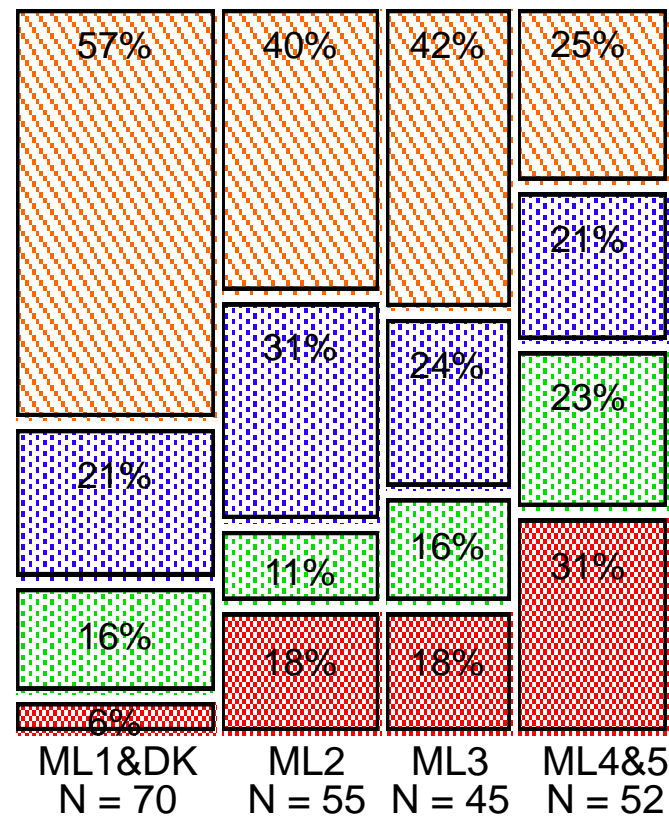
## Requirements / Architectures



Gamma = .37

p = .0002

## Quality Attributes



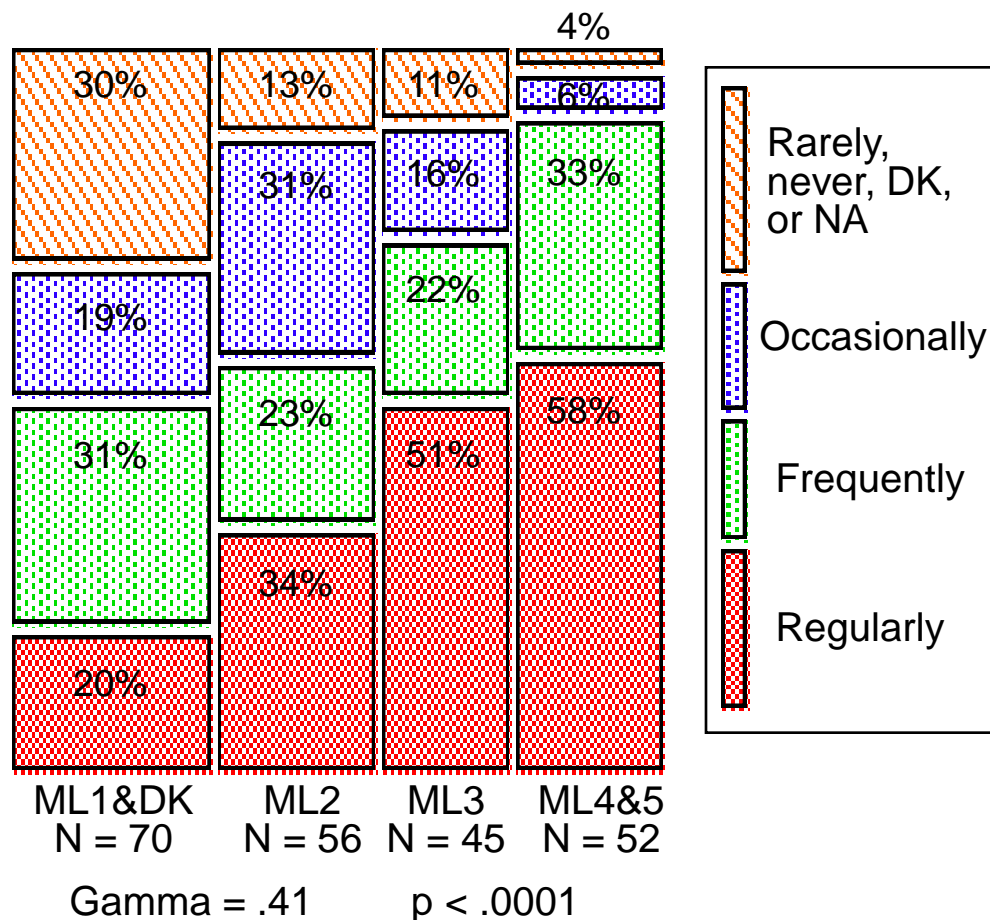
Gamma = .32

p < .008

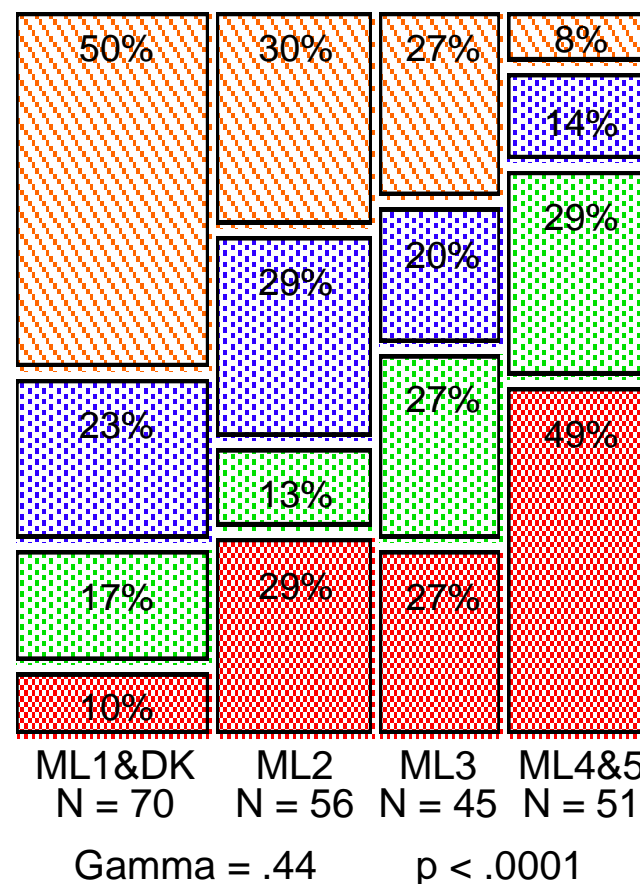


# Product & Quality Measurement Results Reported<sub>2</sub>

## Defect Density



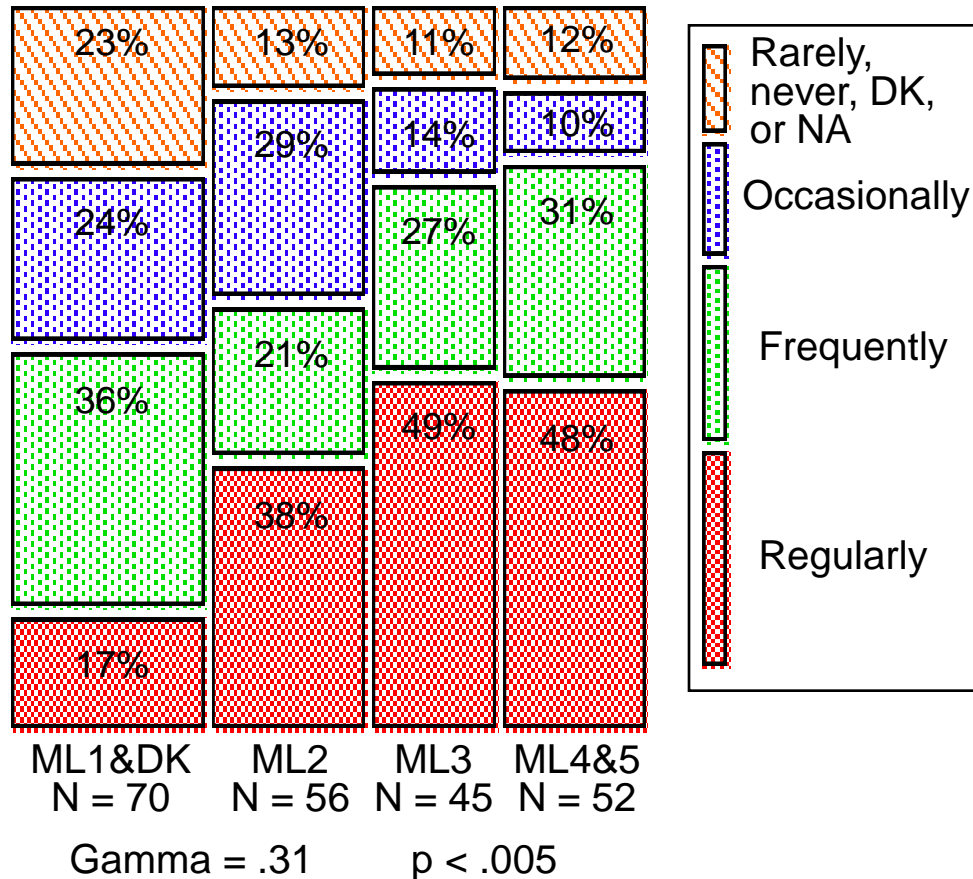
## Defect Phase Containment





# Product & Quality Measurement Results Reported<sub>3</sub>

## Customer Satisfaction



# Similar Results

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For:

- Adherence to work processes
- Effort applied to task
- Estimation accuracy
- Cycle time

Proportions sometimes vary across the distributions.

But there are consistent differences by maturity level.



# Today's Talk

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Purpose & scope of the survey

## Results

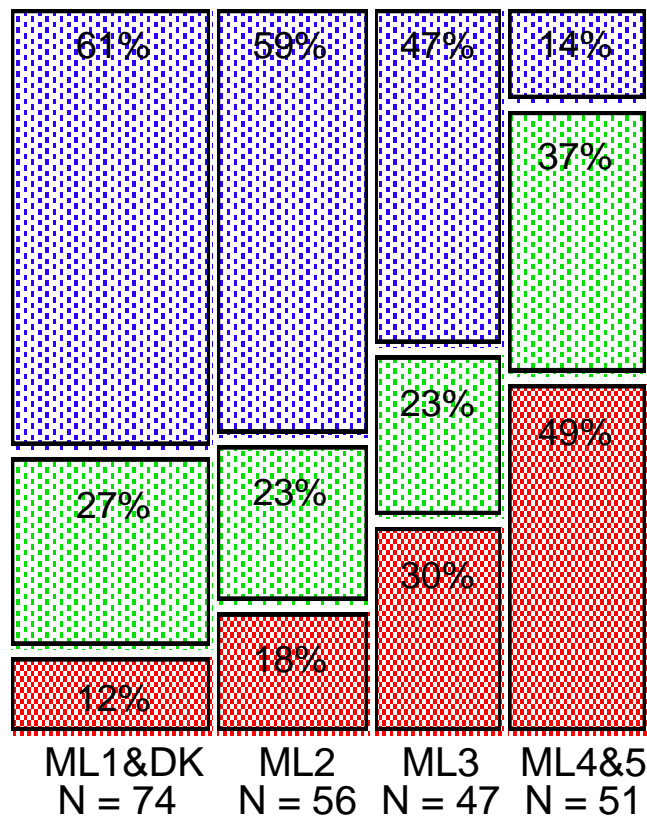
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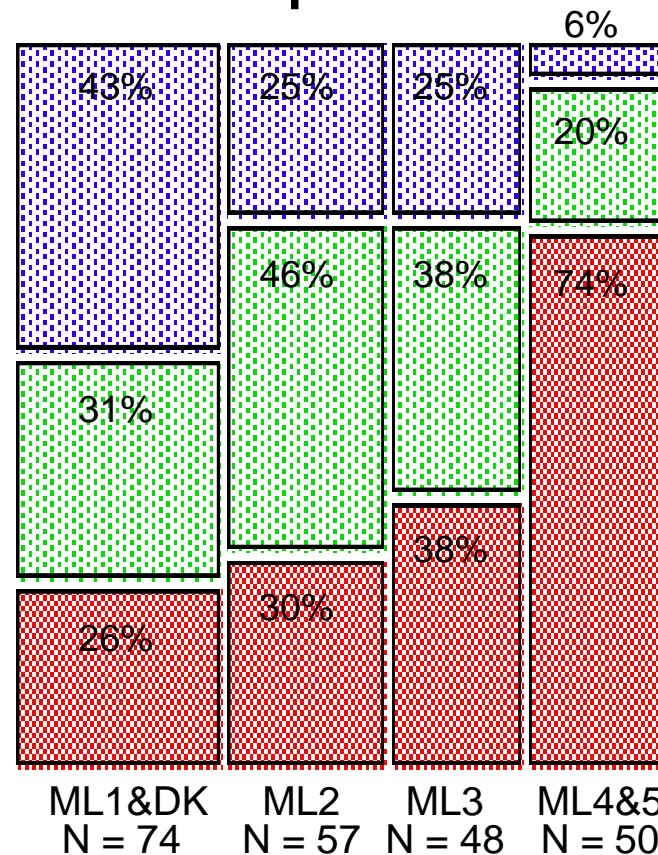
# Differences by Maturity Level: Practices to Ensure Data Quality

## Statistical estimates of measurement error



Gamma = .44      p < .0001

## Checks for inconsistent interpretation

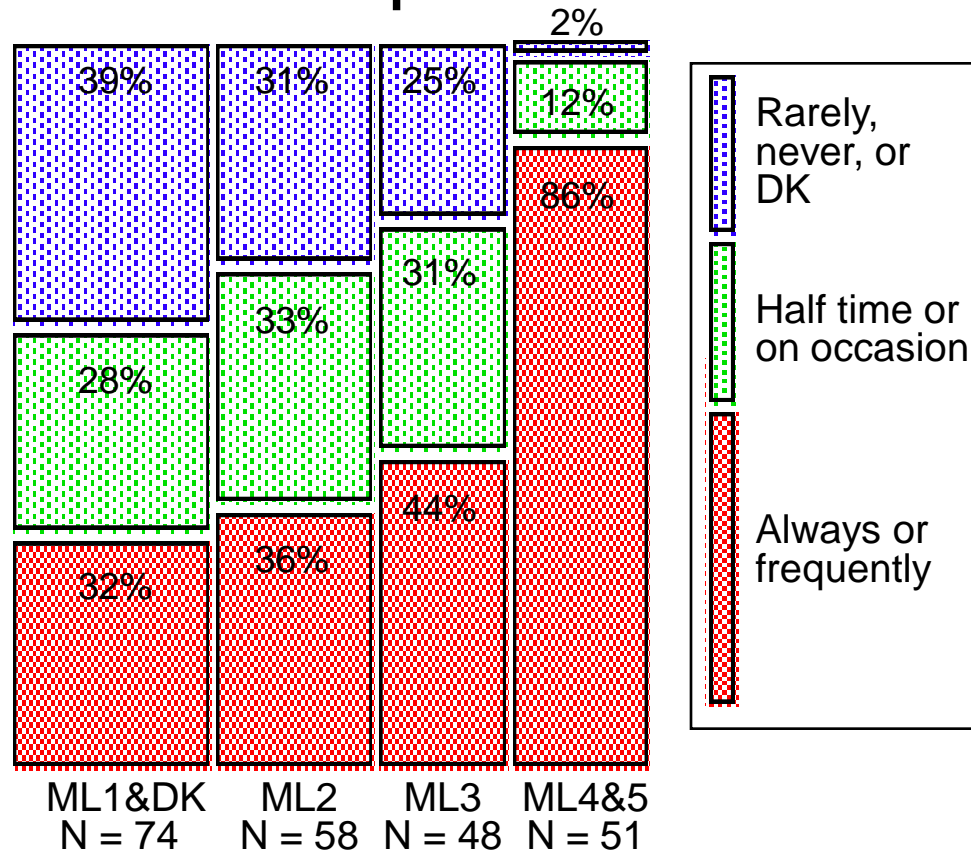


Gamma = .44      p < .0001



# Differences by Maturity Level: Practices to Ensure Data Quality

## Checks for unusual distribution patterns



Gamma = .46       $p < .0001$



# Similar Results

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For:

- Out of range & illegal values ... Number & distribution of missing data
- Missing data not treated as zero ... Precision & accuracy tests
- Other aspects of alignment & coordination of measurement activities
  - Understandable & consistent measurement definitions
  - Understandable & interpretable measurement results
  - Use of “standard” measurement methods
  - Measurable product & service criteria
  - Measurement used to understand product & service quality
  - Documented data collection process
  - Documented process for reporting results
  - Corrective action taken when thresholds exceeded
  - Understands purposes of the data collected/reported

Proportions sometimes vary across the distributions.

But there are consistent differences by maturity level.



# Today's Talk

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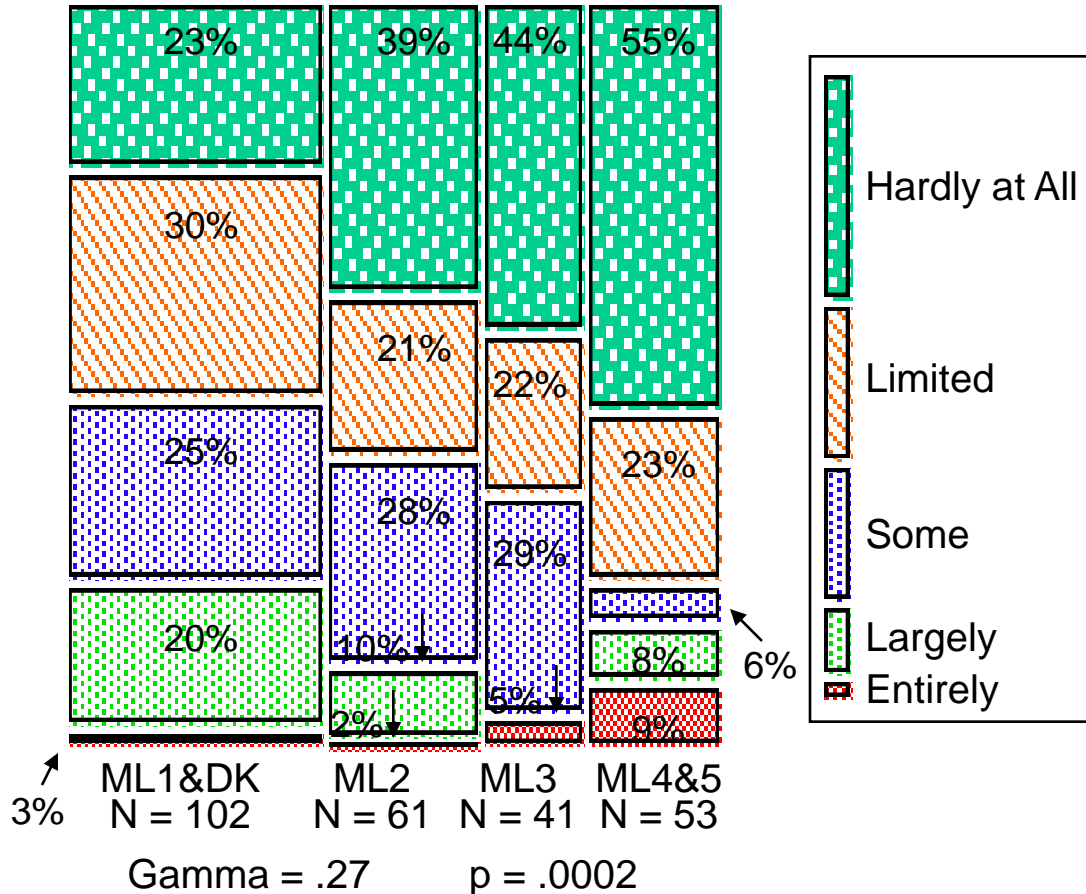
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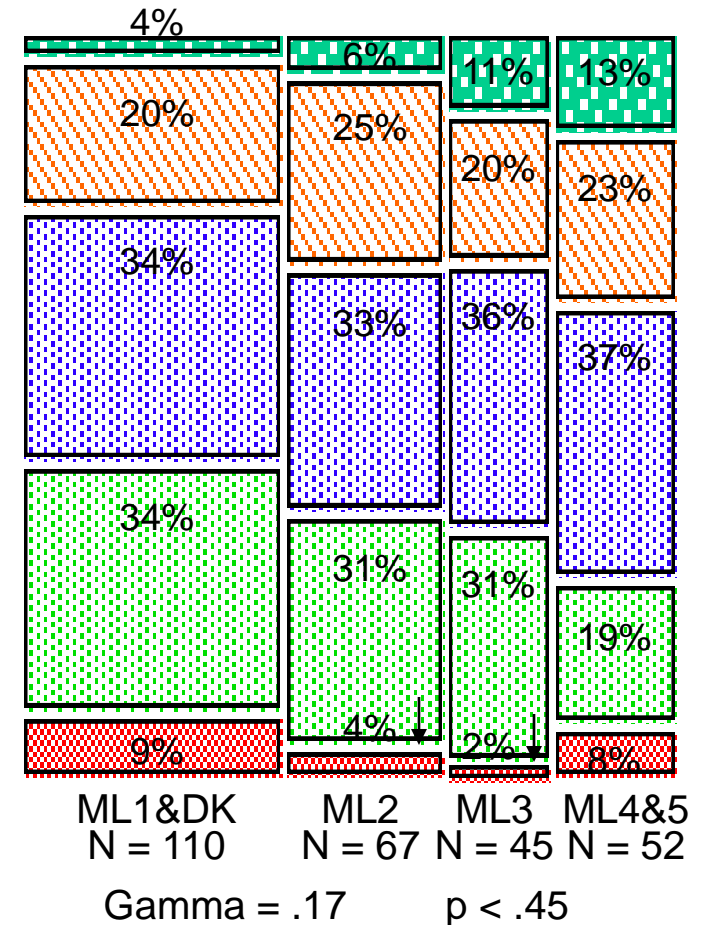


# Organizational Perspectives

## Not Relevant for Decision Making



## Onerous or Burdensome





# Similar Results

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For:

- Stated negatively
  - Inappropriate collection & use of data
  - Resistance to “extra” work
- Stated positively
  - Understandable & interpretable results
  - Data collected are regularly analyzed
  - Measurement an integral part of the business
  - Objective results highly valued

Once again:

- Proportions sometimes vary across the distributions.
- But there are consistent differences by maturity level.

Yet resistance to measurement still exists in our field.

- Even in high maturity organizations



# Today's Talk

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**Summary, lessons learned & next steps**



# Summary of Results

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Characteristic differences associated with CMMI Maturity level achieved

- Measurement capability & performance outcomes
- Common stair step pattern up the maturity levels
- Some quite substantial

Still, some of the results imply room for improvement

- Sometimes substantial room

Even in higher maturity organizations

- Although the expectations for quality & “goodness” may well be higher there too
- Jim Herbsleb & I saw a similar pattern years ago
  - For process champions *versus* practitioners & managers



# The Future

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Relatively little data yet exist for meaningful comparisons among software & systems engineering projects & organizations

- Hence tendency to cover too much at once in a single sample survey

Considering variants on matrix sampling strategies for 2008 survey

- Answer only a subset of questions ... to avoid over-burdening the respondents

“State of the practice” can refer to very different target populations

- The SEI customer base ... the broader software & systems engineering community ... or those organizations that more routinely use measurement?
- Of course, the answer depends on the purposes of the survey



# Next Steps

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## Our plans

- We will track change over time & go into further depth about focused topics from the perspective of current measurement practitioners

## Considering parallel samples for 2008

- A short set of questions for tracking the diffusion of measurement through the broader software & systems engineering community
- Possible focus on issues faced with respect to the adoption & use of high maturity measurement practices

Also fielding a survey on Program Office acquisition capabilities (early 2008)

Of course, there is no shortage of additional topics for the future

- In the SEI series or in those that we hope to see done by others



# Thank You for Your Attention!

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